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241 312 water the lands where there existed traces of former irrigation, as, for instance, the disused canal system of Gavkhore on the right bank of the Amu Darya opposite Khorezm? But no: Barthold was a mere professor, who had made for himself a picture of the country from 'Sart' sources. The Russian engineers were convinced of their wisdom, and money was devoted to schemes which, far from turning the land into a garden, in a few years led to water-logging, no measures having been taken to prevent the land turning into a morass, a home of reeds and waterfowl and a source of malaria.

> In September 1922 [says Togan], I passed by the lower side of the canals in Mirza Chöl, and a Kazak showed me how the poplars planted by the Russians were drying up, and the surface of the land, cultivated a few years before with care and trouble, was now covered with saltpetre.[1]

●653 312 The Tsarist irrigation engineers seem to have had little conception of the dangers of water-logging and saltpetre which arise in a flat riverain country under a tropical sun, when water is brought to it and the fall is insufficient for natural drainage. The remedy lies in the provision of artificial drainage by digging channels to lower the watertable, but this is not always easy and it is very expensive. Even in their weirs and dams the Russian engineers set their bricks much too loosely, as compared with the old brick walls of indigenous canals, which had held for centuries. An effort by the Grand Duke Nicholas at the end of the XIXth century to construct a perennial irrigation system on the Amu Darya in Khorezm resulted only in cutting across and destroying the old indigenous inundation channels. The project was conceived as one in line with British irrigation works in the Panjab and in Egypt, but it is evident that the Russian engineers of that time had much to learn both as regards original canal construction and the remodelling of old works.

The Soviets have given great attention to irrigation works in Central Asia, and have certainly profited from the mistakes of their predecessors. Although in this case also it is hard to

[1] *Op. cit.* p. 295.

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disentangle achievement from expansive visions existing only in the planner's mind, there is no doubt that in Farghana, in the Chu–Talash area, and also on the Zarafshan and the Vakhsh, much good work has been brought to a conclusion. The best-known completed works are:

(*a*) The Stalin Great Farghana Canal, 270 km. long.
(*b*) The Mikoyan, or Northern Farghana, Canal, 165 km. long.
(*c*) The Andreev, or Southern Farghana, Canal, 108 km. long.
(*d*) The Katta Kurgan and Verkhno-Bukhara Reservoirs on the Zarafshan.
(*e*) The Great Chu Canal, 270 km. long.
(*f*) The Vakhsh Canal.

The construction of the first was widely advertised, with due praise allotted to the 160,000 *Kolkhoz* members who dug it out, and completed it in forty-five days. The availability of *corvée* labour of this kind, which can be used in the off-season for irrigation work, must greatly aid the authorities in their task, not only on construction but on maintenance and silt-clearance. The official case is that a considerable percentage of all *Kolkhoz* workers in canal areas is used for such duties, and the labourers while absent from their homes receive their fair share of *Kolkhoz* produce. That may work in the rich and smiling Farghana Valley. But how is the case with those transported to dig in the wastes of the deserts? The logistical effort alone needed to feed armies of workers in the Karakum must be colossal.

It has been suggested that construction of the Stalin-Farghana Canal called out nearly one million labourers and that there was suffering on a large scale. Yet, in the face of all criticism, there remains an impression that this in itself was a great work, which has added much to the fertility of an already productive region. Systems of government change, but an irrigation work remains.

Since the war there has been planning on a far grander

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Since the war there has been planning on a far grander
653 scale. The first two schemes which follow may be called
312 'local' in the sense that, in appearance at least, they are not
185 part of a continental linked project dealing in the waters of more than one river. These two projects are:

(i) *The Karakum Canal*

The project was an old one, but it was revived in 1945, and ratified in 1947. The main channel is to be some 350 miles long and to irrigate nearly half a million acres. The headworks were to be somewhere near Kerki on the Oxus left bank, and the main objective is to increase the cultivated area watered by the Murghab and Tejen rivers in the Merv and Serakhs oases. Work was stated to have been started in 1949.

A work of this kind, skirting the Kopet Dagh line of mountains which forms the Persian frontier, must cross the natural drainage lines of the country, and involve heavy bridging or siphoning and much danger of being breached by floods, to say nothing of being choked by sand-drifts. Without any local knowledge it is possible to affirm that this canal must take time to construct and will be expensive to maintain. Confidence in the Soviet engineers is not increased by loose talk that the canal will be used for shipping. Navigation and irrigation are ill partners.

(ii) *The Uzbek, or Upper Oxus, Canal*

This project was planned by the Uzbek Academy of Sciences in May 1947. It is a very large scheme for a canal 500 miles long to supplement the irrigation at the tail of the Kashka Darya and the Zarafshan systems — among the best cotton-lands in Central Asia — by water from the Oxus. The project was described at some length by a spokesman of the Central USSR Ministry of Agriculture. The plan envisages the construction of a headworks at Kelif on the Oxus right bank, where the river finally emerges from the hills into the plain. At this point the right bank rests on a spur of the Hissar Range, a rocky eminence which canalizes the channel

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and prevents it from shifting as it is always doing in its course through the plains lower down. On the face of it then the site is well chosen for the headworks of a perennial canal. At this point a dam described as 6 km. long and 20 metres high was to be constructed. For the next 100 km. the main canal would run along the skirt of the Hissar Range, passing on its way a point named Akyar where it would drop 34 metres, the fall being used to establish a hydro-electric power station. The canal would then swing northward to cross the Kaskha and Zarafshan rivers and augment the water-supply in both. The forecast spoke of opening up new irrigation to the extent of 1·2 million hectares, or nearly 3 million acres, and the estimated cost was 7000 million roubles. No date of completion was named.

This project, like the last, involves cutting across the natural drainage lines of the country, and the upper part of the main channel, skirting the great chain of the Hissar mountains (rising at one point to over 15,000 feet) will necessarily have to withstand occasional floods of extreme violence. Further, the crossing of the Kashka and Zarafshan basins at a point presumably not far distant from the debouchment of those rivers into the plains will demand engineering and constructional skill of no mean order.

The plan calls for the establishment on the falls of hydro-electric generating stations of an aggregate capacity of 1 million kilowatts, equal to about ten times that of the Ardnacrusha Station on the Shannon.

The spokesman said that these two canals together were expected to take nearly 2000 cubic metres per second[1] from the Amu Darya. On the assumption that each is designed to take 1000 cubic metres, each of these canals would be about twice as large as any of the great works constructed in the Panjab. This 2000 cubic metres volume is quoted as taking about half the total discharge of the river even in July and

[1] To convert cubic metres into the normal British engineer's standard of water-volume, viz., cubic feet per second, an adequate rule of thumb is to multiply by thirty. 1000 c.m.s. would therefore be equivalent to about 30,000 'cusecs'.

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August, the flood months owing to summer melting of snow in Oxus' 'high mountain cradle in Pamere'. A draught on the river of this order must of course put in jeopardy the irrigation down-stream in the Khorezm area, but the spokesman met this by explaining that three reservoirs were to be constructed to store 6000 million cubic metres in the seasons of low demand.

These two projects for irrigation from the Oxus, great as they are, pale into insignificance when set against an immense integrated plan, described as 300 times the size of the T.V.A.[1], for the application of the latest sciences to the Dnieper, Don, Volga and Amu Darya basins in the connected fields of irrigation, navigation, hydro-electric power and afforestation. Here we are concerned with the Amu Darya only, but the plans announced cover much the same ground on the European rivers. Over the whole field the planners speak in terms of transforming an area of two million square miles, two-thirds the size of the United States. The rivers are to be dammed at a number of points, the dams forming reservoirs many miles across; power stations of great capacity are to be established at these barrages with irrigation canals taking off at the same points; ocean-going steamers are seen as penetrating to the lakes through locks; and finally belts of forest, three miles wide (quite modest this), are to be planted in the valleys 'to keep them damp and on the watersheds to let the run-off from melting snows down gently'. In the Karakum, an awkward place for labour, the forests are to be sown with seed broadcast from aircraft. Finally, the suggestion is that, to avoid a fall in the Caspian Sea following the diversion of rivers to irrigation, waters flowing to the Arctic are to be impounded to compensate the southern rivers. A presumably serious commentator[1A] has written that it is possible that ultimately no water from Siberia will go to the Arctic, and it has even been suggested that the consequent greater salinity of the Arctic Ocean may reduce the size of the Polar ice-cap.

[1] Tennessee Valley Authority.

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Turning more particularly to that part of the scheme to be derived from the waters of the Amu Darya, to be called the Turkmenian Canal, the same commentator [1A] stated:

> The scientists told me a great deal about how they had planned the scheme for the Karakum desert. . . . They are chosen to cover the whole range of interests . . . there are hydrologists, navigation experts, electrical experts, every kind of engineer, soil scientists, zoologists, botanists, geologists, there are also geo-physicists and seismologists . . . besides all these there are the archaeologists, who are considered a very important part of the scheme.

In the presence of this battalion of experts from Academies of Sciences, with some conflict of interest (one would think) even in Russia, the genie of the scheme will surely sigh for one good practical engineer.

The Turkmenian Canal itself was announced in September 1950 in a decree of the Central Council of Ministers of the USSR. It is nothing short of an attempt to realize the old dream for the redirection of the Oxus back into its ancient course to the Caspian Sea by means of a canal 700 miles long starting from Takhya Tash on the left bank close to Nukus, skirting the Sarikamish depression (which, being even deeper than the Caspian, would take too long to fill up), and thence along the old bed of the Özboy across the middle Karakum and through the Balkhan gap into the sea near Krasnovodsk.[1] It is not unamusing to reflect that this also was an idea in the minds of Tsarist engineers more than fifty years ago. Curzon, writing in 1889, mentions that as a navigation project it had even occurred to the fertile mind of Peter the Great, and quotes the scornful saying of the German engineer Kiefert referring to the project, when at the height of its favour in the seventies of last century, as the great Central Asian sea-serpent. But it seems clear that a decision has now been taken for a canal to irrigate 1,300,000 hectares or about 3,000,000 acres, and to carry three hydro-electric generating stations, each with a capacity of 100,000 kilowatts (each about equivalent to the Shannon Station in Ireland). Work was to begin in

[1A] Professor J. Bernal, F.R.S., Bib. II, 1.

[1] [See cat. 116, pp. 23-26 -- Analyst]

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1951 and is scheduled for completion in 1957. The official spokesman [1] stated:

> The idea of bringing life to the desert by turning the course of the Amu Darya towards the Caspian Sea originated long ago. Yet Tsarist Russia was incapable of carrying it out. It was on the initiative of Stalin that the Government decision was taken to revive the desert and fulfil the age-old dreams of the people of Central Asia. The special characteristic of the present scheme is that the waters will be used in their entirety for irrigation and will not be discharged into the Caspian Sea as proposed in all preceding projects. All remaining canals of the world, including those of America, Egypt and India, are considerably shorter. . . . Krasnovodsk will receive an abundant supply of water [is this inconsistent with the special characteristic?]. The new irrigation construction is an important link in the great Stalin plan for the transformation of nature. The Caspian desert plain will soon be converted into a marvellous flourishing land.

The project is linked with the railway constructional plan already mentioned for a line northward from Charjui to Kungrad along the Oxus left bank, that described as one of the great railway building feats of all time.[2]

000 In face of the admissions of short supply in the river which will follow the completion of the first two Amu Darya projects above mentioned, it is not easy to see how the Takhya Tash headworks — down-stream of Kelif and Kerki — would find sufficient volume to irrigate the whole of the Karakum from Khorezm to the Caspian. Can it be that this grandiose project for restoring the prosperity of the days before 1573, the year when the Oxus turned to the Aral Sea, is alternative and not supplementary to the Karakum project? It is possible that the surveys may have convinced the Soviet engineers of the difficulties of constructing a canal along the skirts of the Kopet Dagh, with all the dangers of breaching by flood, and induced them to have second thoughts. It is not inconceivable that they, or their political superiors, may have been influenced by the romance which appeals so greatly to the local bourgeois patriots, that of turning the Oxus back

[1] Deputy Minister, Cotton Cultivation USSR.

[2] Bib. II, 10.